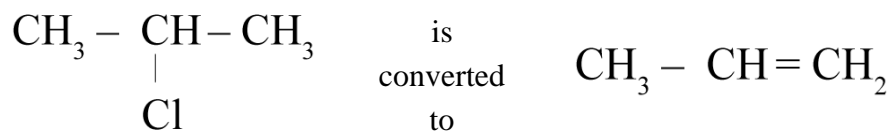
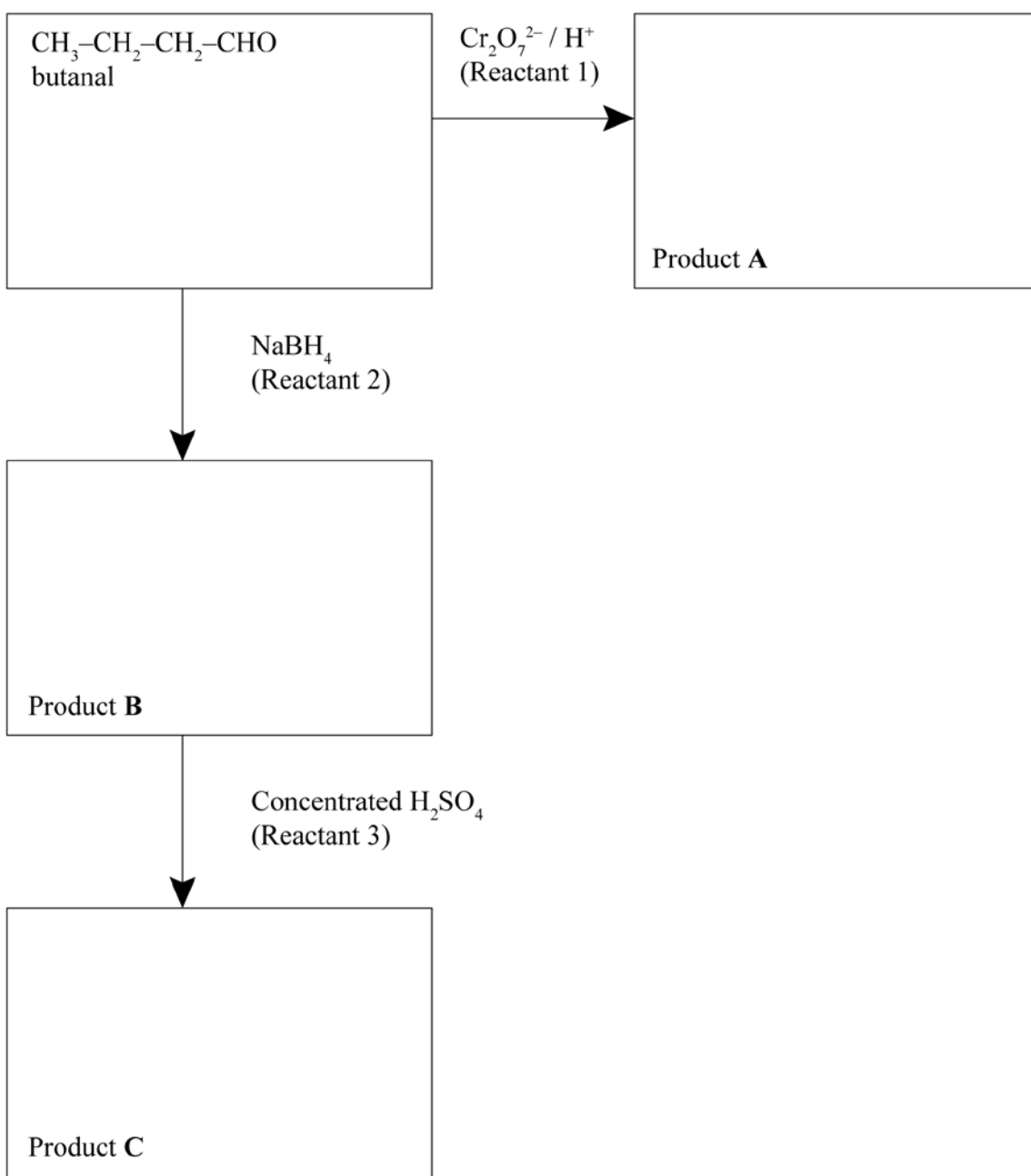


Reaction mechanisms

- 1) For the following conversion, identify the reagent required and state the type of reaction occurring. You should give a reason for your answer in terms of the structure of the reactants and products.

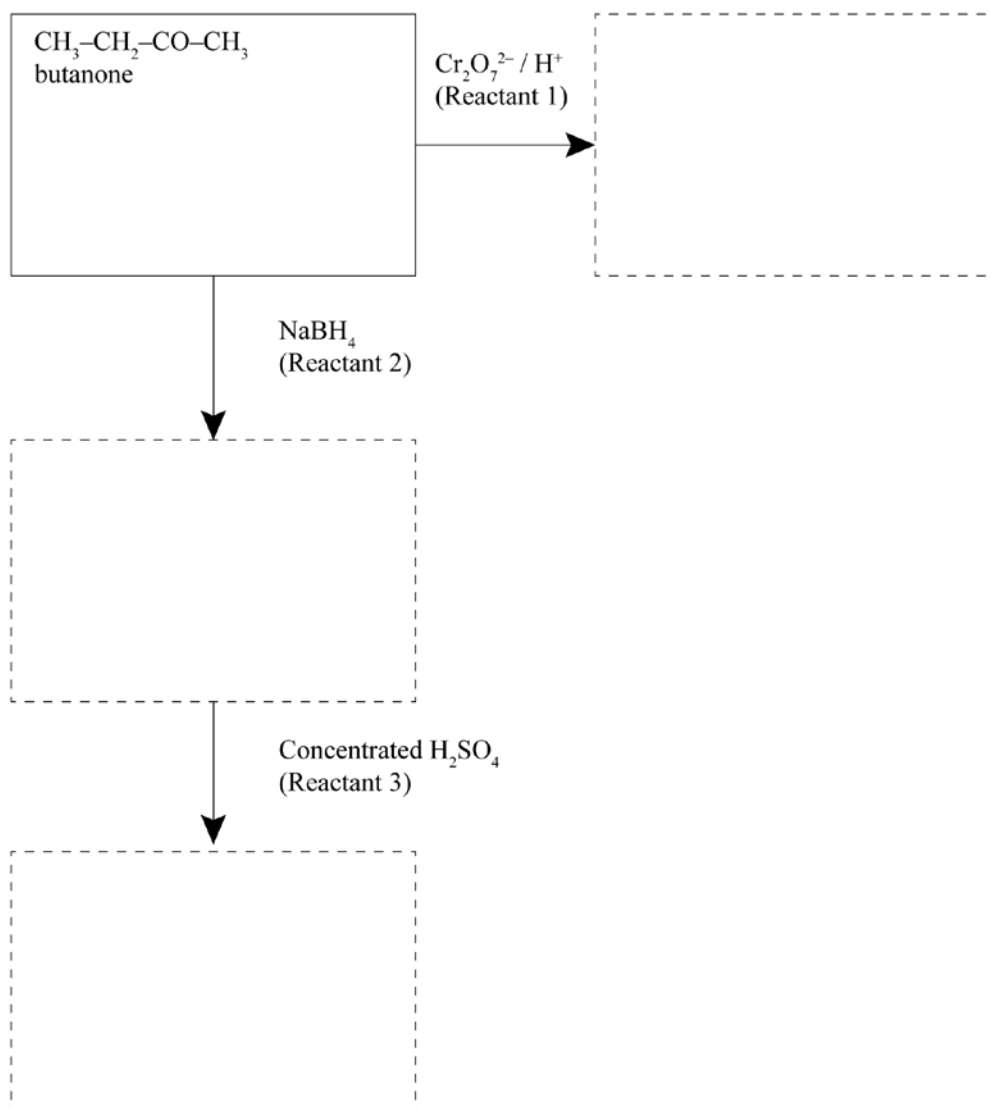


- 2) a) Complete the following reaction scheme that shows some reactions starting with butanal. Give the structural formulae of the organic products **A**, **B**, and **C**.



b) Devise and complete the reaction scheme starting with butanone in place of butanal to show how butanone would react with the reactants 1–3. In your answer, you should:

- identify the products formed in each reaction step; state if no reaction occurs
- write the structural formula for each product formed, including major and minor products (**if any**).

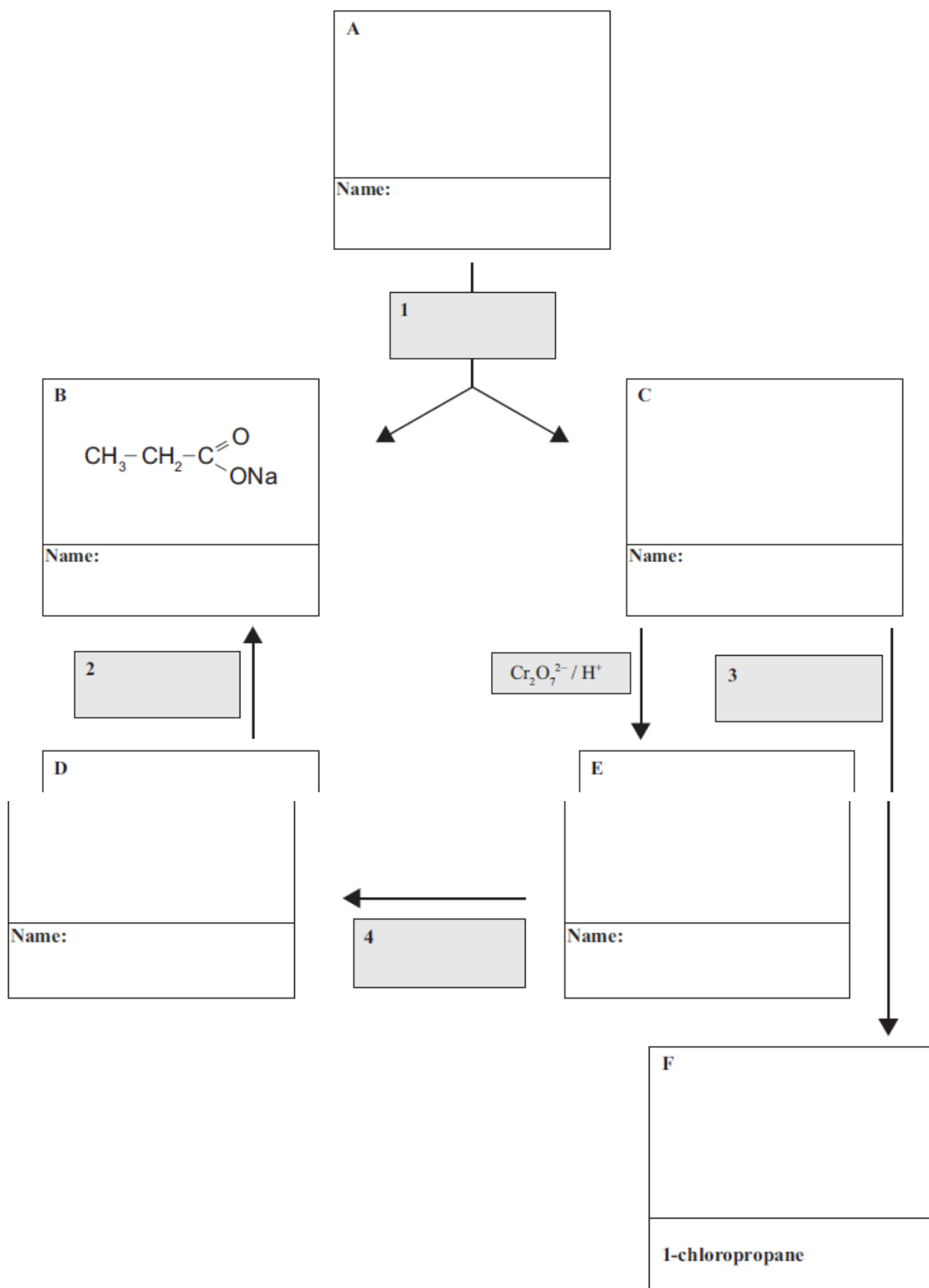


c) Compare and contrast the two reaction schemes. In your answer, justify the reasons for:

- the similarities and the differences between these two schemes
- the products formed in each reaction.

3) The haloalkane 1-chlorobutane can be used to make butanamide. One of the intermediate products is a carboxylic acid. Show, using structural formulae, how this might be achieved in a number of reaction steps. Include all reagents.

4) Complete the following reaction scheme by naming and drawing the structural formula of each of the compounds **A** to **F**. Identify the reagents **1** to **4**, including any necessary conditions, needed to bring about each transformation.



5) The haloalkane, 2-chloro-2-methylbutane, can be prepared by reacting 2-methylbutan-2-ol with concentrated HCl.

i) Write an equation for this reaction using structural formulae.

ii) State the type of reaction occurring, and give a reason for your answer.

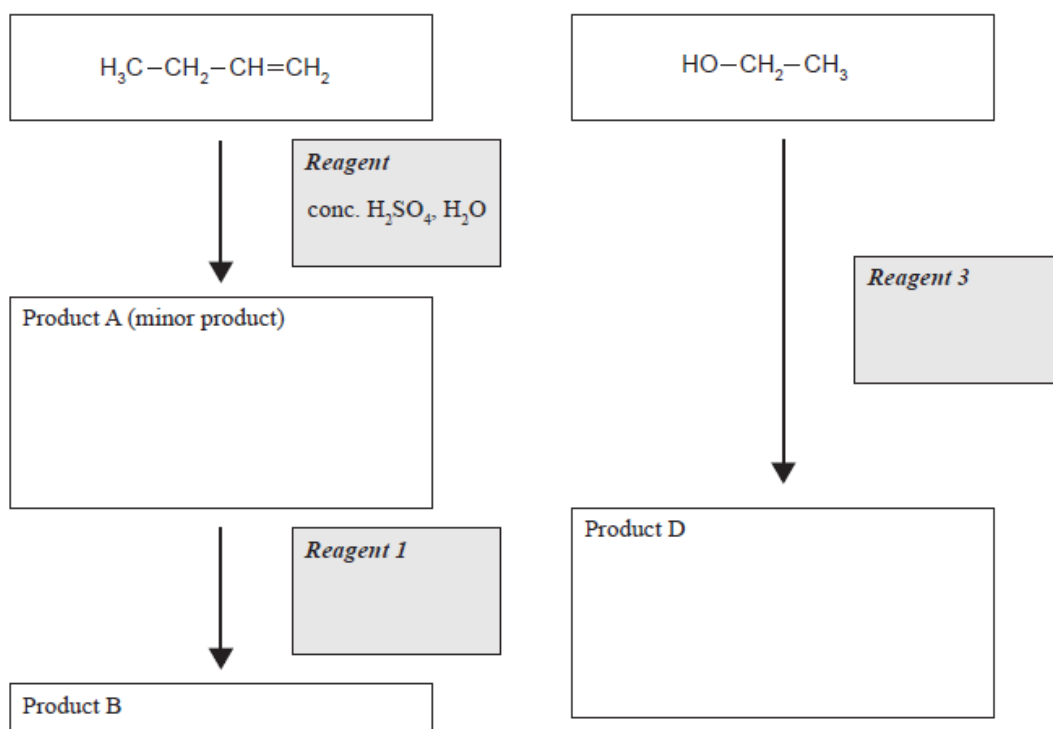
6) Identify the compound from these given: propanoyl chloride, 2-amino-3-methylbutane, pentanal, 4-chlorobutanoic acid that will react as described below, and draw the structural formula for each organic product formed.

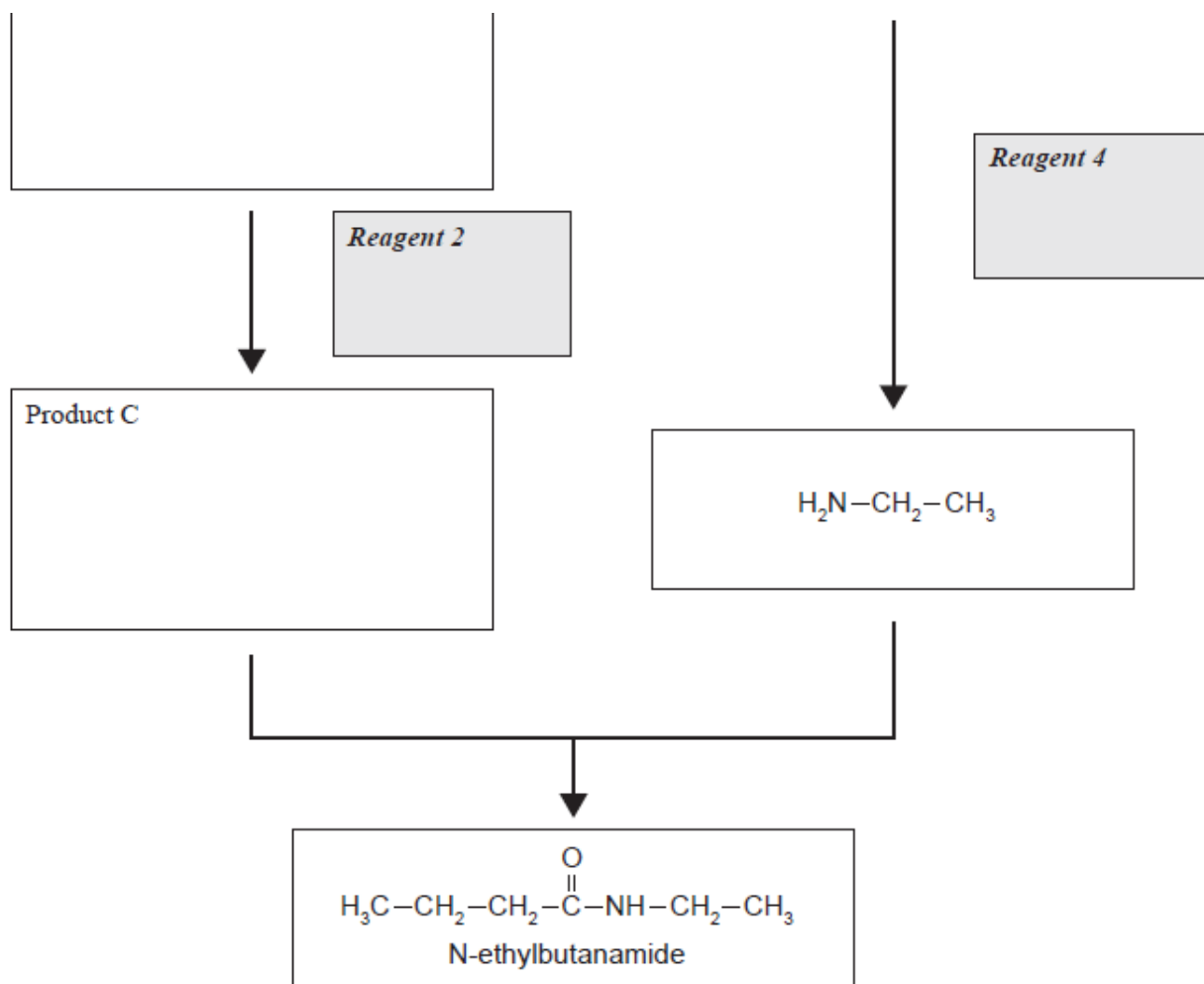
i) Elimination with alcoholic KOH

ii) Oxidation with Fehling's or Benedict's solution

iii) Substitution with aqueous KOH

7) Complete the reaction scheme by giving the formulae for reagents 1 to 4 and the **structural formulae** for the organic products A to D.

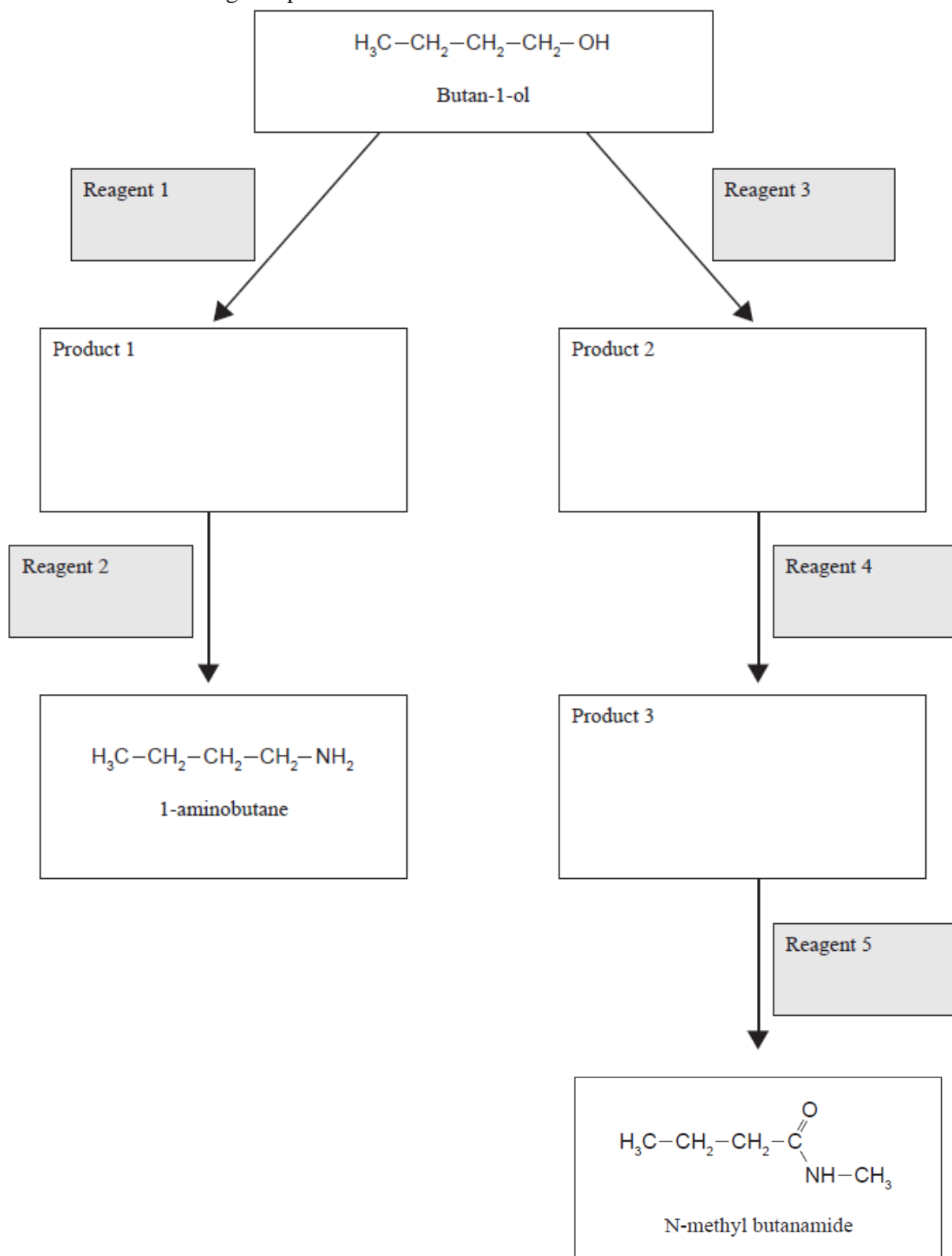




8) Propan-1-ol can be oxidised to produce two different products.

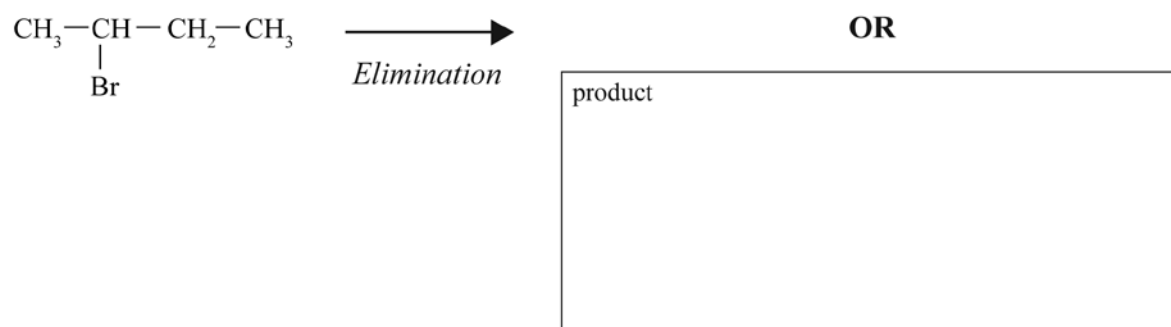
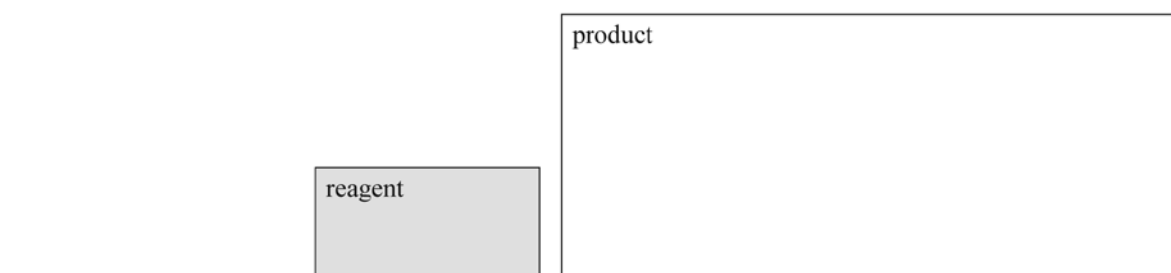
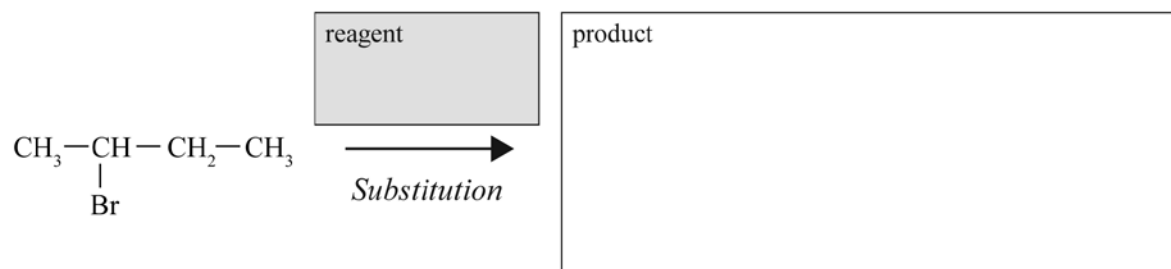
Discuss how to carry out the oxidation of propan-1-ol in the laboratory to obtain two different organic products. The method may use two different samples of propan-1-ol to form each product.

9) Complete the following reaction scheme by giving the formulae for reagents 1 to 5 and the **structural formulae** for the THREE organic products.

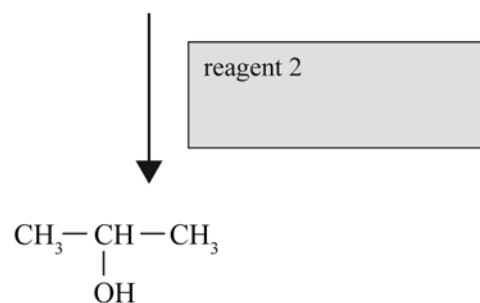
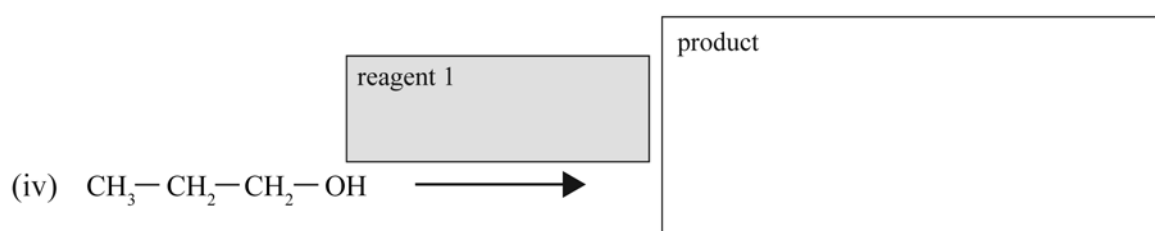
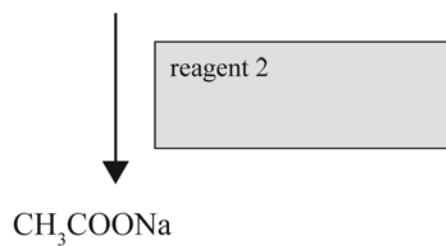
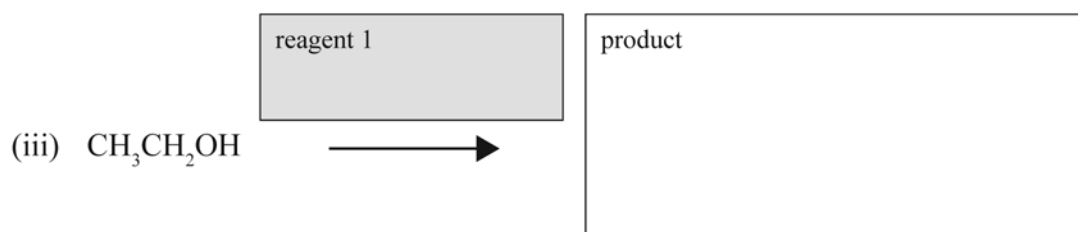
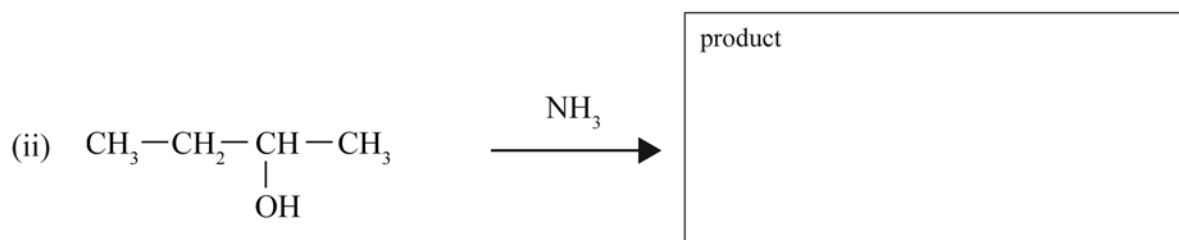
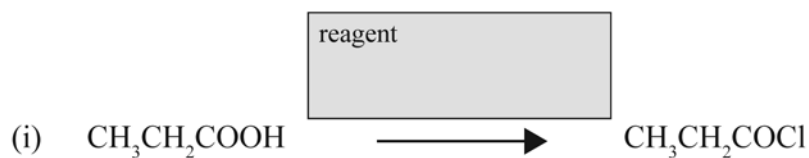


10) 2-bromobutane reacts by *substitution* to form 2-butanol. However, if the reaction conditions are changed, an *elimination* reaction occurs. There are two possible products for the elimination reaction.

Complete the following reaction scheme by indicating the reagents in the shaded boxes and the organic products in the other boxes for each of these reactions of 2-bromobutane.



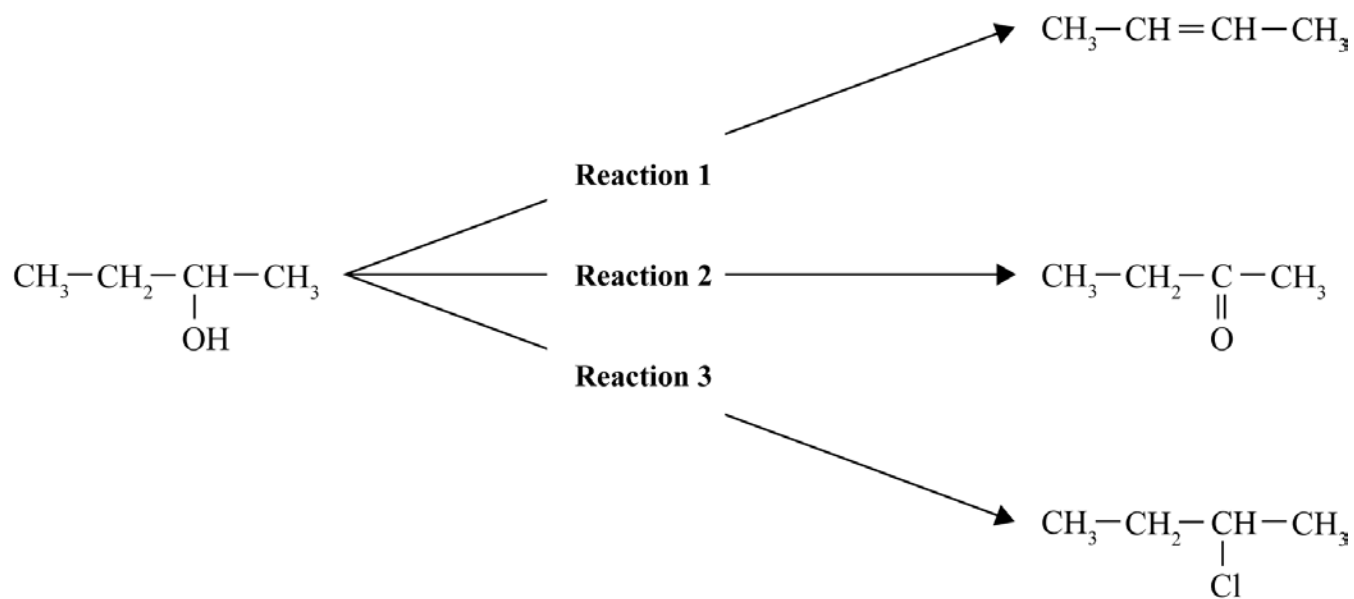
11) Complete each of the equations below by writing the **organic product** in the blank boxes and the **reagent needed** in the shaded boxes.



12) a) For each reaction below, identify:

i) the type of reaction,

ii) the reagent required to carry out the reaction.

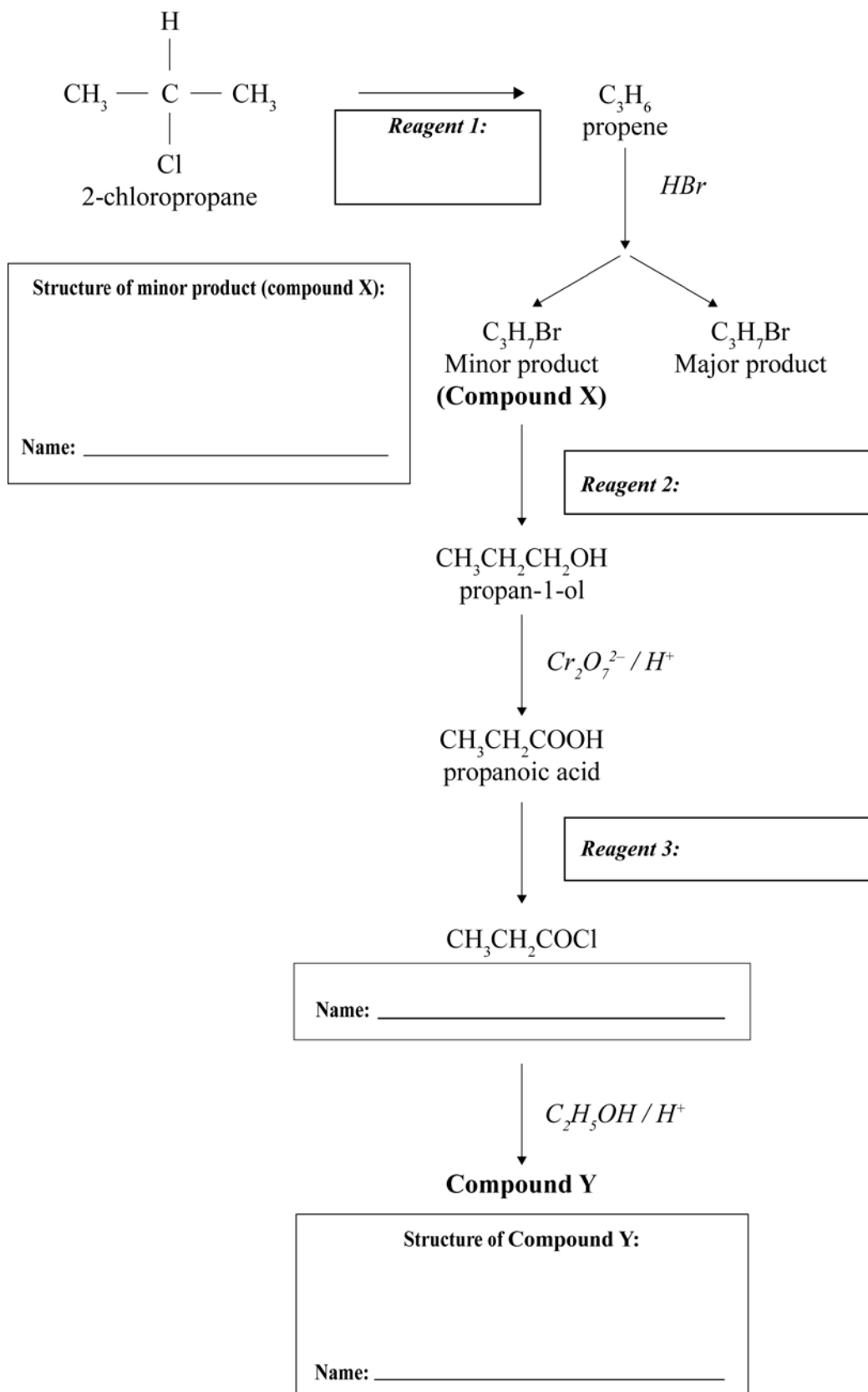


13) Complete the reaction scheme below by:

a) i) identifying the three reagents

ii) drawing the structures of compounds X and Y

iii) naming organic compounds X and Y, and the compound with formula $\text{CH}_3\text{CH}_2\text{COCl}$



b) Each of the parts (i) – (iii) below refers to one step in the reaction scheme. For each part, identify the **type of reaction** (from the given list) and use the reaction in that step to explain the term.
addition, elimination, oxidation, polymerisation, substitution

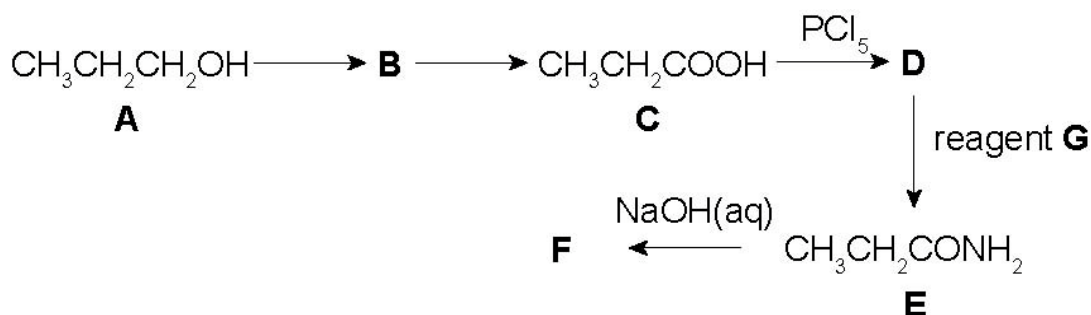
i) 2-chloropropane is converted to propene.

ii) Compound X (the minor product) is converted to propan-1-ol.

iii) Propan-1-ol is converted to propanoic acid.

c) When HBr is reacted with propene, there are TWO possible products. Discuss how the compounds formed in this reaction scheme (on page 2) would vary if these two products were not separated before reagent 2 is added.

14) The sequence below summarises, in part, the reactions for the preparation of an organic compound, F.



a) The conversion of compound A into compound C initially involves formation of compound B.

i) Draw the structural formula of compound B and name it.

ii) Describe how the conditions in part (b) could be modified to produce compound B rather than compound C as the major product. Give reasons for these modifications.

b) Compound C is reacted with PCl₅ under anhydrous conditions to form compound D.

i) Draw the structural formula of compound D and name it.

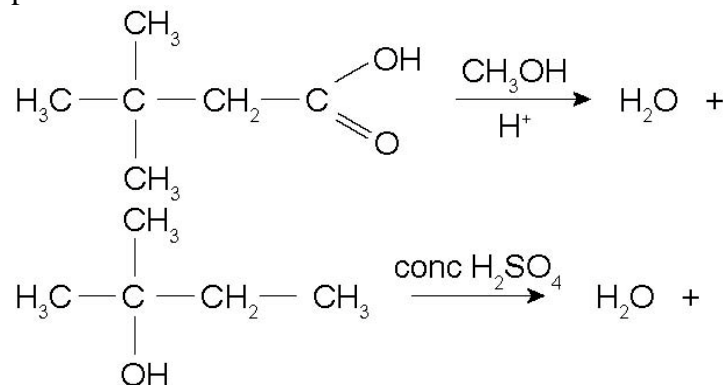
ii) What is meant by 'anhydrous conditions' and explain why such conditions are necessary for this reaction.

c) i) Name compound E.

ii) Identify reagent G.

d) Compound E can be hydrolysed by reaction with aqueous sodium hydroxide. Name the products of this hydrolysis reaction and draw the structural formula for each.

15) The following reactions involve the loss of water. Clearly show the **structure** of one major organic product of each of these reactions.



Identify the type of reaction that is occurring in each case above: